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STAFF APPRAISAL REPORT

KOREA

ENVIRONMENTAL RESEARCH AND EDUCATION PROJECT

APRIL 15, 1993

Country Department I
East Asia and Pacific Regional Office

CURRENCY EQUIVALENTS

Currency Unit - Korean Won (W)

US$1.00 = W780
(April 1993)

WEIGHTS AND MEASURES

Metric System

ABBREVIATIONS

EA	-	Environmental Administration
EERC	-	Environmental Education Review Committee
EFB	-	Education Facilities Bureau
ELPD	-	Education Loan Projects Division
EMB	-	Environmental Management Bureau
ERAC	-	Environmental Research Advisory Committee
ICB	-	International Competitive Bidding
MOE	-	Ministry of Education
MOEN	-	Ministry of the Environment
MOHSA	-	Ministry of Health and Social Affairs
MOST	-	Ministry of Science and Technology
NICEM	-	National Instrumentation Center for Environmental Management
NIER	-	National Institute of Environmental Research
O&M	-	Operations and Maintenance
OSROK	-	Office of Supply, Republic of Korea
PCC	-	Project Coordinating Committee
PCR	-	Project Completion Report
PPAR	-	Project Performance Audit Report
R&D	-	Research and Development
S&T	-	Science and Technology
STEB	-	Science and Technology Education Bureau
SNU	-	Seoul National University
SOE	-	Statements of Expenditure
TAP	-	Technology Advancement Project
UEO	-	University Education Office

FISCAL YEAR

January 1 - December 31

ACADEMIC YEAR

March - February

KOREA

ENVIRONMENTAL RESEARCH AND EDUCATION PROJECT

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The report is based on the findings of a preappraisal mission which visited Korea during July - August 1992 and an appraisal mission consisting of Mr. W.E. Rees (mission leader), Ms. K. Johnston (institutional specialist) and Messrs. S.Z. Sung, V.G. Desa and I. Irvine (consultants), which visited Korea during November 1992. Peer reviewers were Messrs. T. Wiens (EA1AG), C. Rees (ENVLW) and V. Greaney (ASTHR). The documents have been endorsed by Messrs. J. Shivakumar, Chief, EA1PH, and Callisto Madavo, Director, EA1.

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KOREA

ENVIRONMENTAL RESEARCH AND EDUCATION PROJECT

Loan and Project Summary

Borrower	:	Republic of Korea
Beneficiary	:	Not applicable
Amount	:	US$60 million equivalent
Terms	:	Repayable in 15 years including 5 years of grace at the Bank's standard variable interest rate.
Project Description	:	The objectives of the project are to assist in upgrading the capacity of selected agricultural and veterinary colleges to undertake research into key environmental problems, reinforce the environmental aspects of basic science programs in the colleges in order to strengthen the training of environmental professionals and to establish appropriate arrangements for improving environment-related research and teaching programs. The project would include specialized equipment to be financed by the Bank (baseline cost, US$58.4 million) to support: (a) the National Instrumentation Center for Environmental Management (NICEM - US$10.7 million); (b) selected agricultural colleges (US$34.7 million); and (c) selected veterinary colleges (US$13 million). The Government would finance complementary inputs (US$21.7 million) related to making the equipment operational and maintaining it thereafter, namely, local transportation and installation costs, O&M and consumables. The project would also include overseas training, experts and library materials (US$1.8 million).
Benefits and Risks	:	The project would strengthen the teaching of environment-related programs which in turn would lead to the production of better-trained environmental professionals. The project would also strengthen environmental research thus leading to a better understanding of key environmental problems thereby improving the basis for policy making and increasing the effectiveness of environmental protection programs. There are no major risks associated with the project.

Project Costs:

	Local	Foreign	Total
	--------(US$ million)------		
NICEM	3.9	12.4	16.3
Agricultural Colleges	11.3	36.4	47.7
Veterinary Colleges	4.5	13.4	17.9
Baseline Cost	19.7	62.2	81.9
Contingencies			
Physical	1.0	3.1	4.1
Price increase	4.2	7.1	11.3
Subtotal	5.2	10.2	15.4
Total Project Cost/a	24.9	72.4	97.3

Financing Plan:	Local	Foreign	Total
	-------(US$ million)-------		
Government	24.9	12.4	37.3
IBRD	-	60.0	60.0
Total	24.9	72.4	97.3

Estimated Disbursements:

Bank FY	1994	1995	1996	1997	1998	1999
Annual	4.0	12.0	22.0	15.0	6.0	1.0
Cumulative	4.0	16.0	38.0	53.0	59.0	60.0

/a Does not include duties, taxes and fees estimated at US$5 million.

Economic Rate of Return: Not applicable.

Map: IBRD No. 24628

KOREA

ENVIRONMENTAL RESEARCH AND EDUCATION PROJECT

I. ENVIRONMENTAL MANAGEMENT, EDUCATION AND RESEARCH

A. Environmental Institutions and Policies

1.1 The spectacular development of Korea over the last three decades has been accompanied by rapid industrialization and urbanization, and the restructuring of agriculture which resulted in a declining farm population together with rising agricultural productivity and incomes. As a result of the rapid growth of industry and the cities and steadily rising living standards, environmental problems began to emerge in the 1980s. Air, soil and water pollution increased with the rapid increase in motor vehicle ownership, rising volumes of household and industrial waste and the growing use of agrochemicals. These problems received little attention during Korea's single-minded pursuit of economic growth. But in recent years, increasing political liberalization has allowed the media and the growing middle class to openly debate environmental issues and to press the Government for action in addressing environmental problems[1/]. The Government has responded by expanding the environmental legal framework, tightening regulatory activities, improving monitoring capabilities, etc.

1.2 The first major step in creating an institutional and legal framework to address environmental concerns was taken in 1977 with the establishment of the Environmental Management Bureau (EMB) under the Ministry of Health and Social Affairs (MOHSA). The EMB had divisions for environmental planning, air and water quality. This was followed in 1978 by the Environmental Preservation Law, the first major environmental statute in Korea. This law introduced a number of important regulatory devices such as the promulgation of environmental standards, environmental monitoring, environmental impact assessments for new projects, emission standards and control, etc. To strengthen implementation of the law, the EMB was upgraded in 1980 to the Environmental Administration (EA) with the status of an independent agency under MOHSA. Also in 1980, six regional environmental monitoring offices were set up under the EA.

1.3 The increasing complexity of environmental issues and the growing sensitivity to them in the 1980s led the Government to conclude that existing legislation needed to be broadened and its implementation strengthened. This resulted in 1990 in the upgrading of the EA into the cabinet-level Ministry of Environment (MOEN) and, in 1991, in the introduction of new basic legislation

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1/ Environmental problems, although severe, are showing some improvement in certain areas. For example, the concentration of sulphur dioxide in Seoul decreased from 0.056 ppm to 0.043 ppm between 1985 and 1991, and in Pusan, from 0.047 ppm to 0.038 ppm in the same period. Water quality in the Han River improved by about 9% and in the Nakdong River by 17% during 1985-90. On the other hand, domestic solid waste in Korea increased by 25% during 1987-90 and industrial waste by 52% in the same period.

(the Basic Environmental Policy Law). This was supported by separate laws dealing with specific problems such as air preservation, water preservation, noise control, hazardous substance control, solid waste management, marine pollution, etc. Enactment of this legislation has given the Government a stronger mandate to address a broad range of environmental issues. The legislation is also subject to periodic review and has already been revised with regard to solid waste and marine pollution, and natural environment preservation.

1.4 The key role in monitoring environmental performance and enforcing the regulations lies with the Ministry of Environment (MOEN). It also has a policy and planning role which covers the formulation of comprehensive environment plans and policy formulation in respect of air and water quality, waste management, environmental impact assessment and natural resource conservation. MOEN also has overall responsibility for carrying out environmental impact assessments. Technical support is provided by the Engineering and Technology Development Bureau of MOEN. Three technical bureaus are responsible for the management of air quality, water quality and waste management. The bureaus are responsible for implementing quality preservation plans and setting environmental standards. They oversee the work of the six regional environmental offices of MOEN, which are responsible for ongoing monitoring activities, collection and analysis of statistics, oversight of waste processing facilities, etc. The research arm of MOEN is the National Institute of Environmental Research (NIER), whose activities are described in more detail in para. 1.13. Until 1991, NIER was responsible for training environmental personnel, mainly for MOEN's regional offices and for local authorities. At the end of 1991, NIER's training department was reorganized as a separate Training Institute for Environmental Officials.[2/]

1.5 Under the jurisdiction of MOEN are several other agencies. The Central Environmental Disputes Coordination Commission coordinates investigations into environmental disputes and the assessment of damages carried out by the regional commissions (para 1.6). The Korea Resources Recovery and Reutilization Corporation is responsible for the collection and treatment of recyclable waste, technology to improve such treatment, reutilization of waste products (paper, oil, rubber, etc.) and the operation of a waste products management fund. The Environmental Management Corporation builds and operates industrial waste and garbage treatment facilities and landfills. It also provides technical support for the design and construction of local treatment facilities and helps to finance these facilities through a fund which receives charges made against industry for the discharge of pollutants above permissible levels.

2/ The Institute has a staff of 35 which is supplemented by guest lecturers, mainly from the universities. In 1991 environmental training was provided to 3,293 persons from the public and private sectors. Courses covered such topics as analysis, testing and public policy monitoring.

1.6 In June 1992, the Government decided to decentralize a number of monitoring and enforcement responsibilities to the 14 municipal and provincial governments. The latter are now responsible for guidance and inspection of firms, issuance of permits and registration of pollutant-discharging firms, levying and collection of discharge taxes and negligence fines, and closing down repeat offenders. MOEN retains central authority for environmental impact assessments and, through its regional offices, local responsibility for monitoring air, water and soil quality and for the registration of toxic chemical manufacturers. The decentralized activities will be carried out by the municipal/provincial Departments of Environmental Protection, which already exist. However, the latter are being reinforced by over 1,500 new environmental personnel to be allocated to the local authorities. Fourteen local Environmental Disputes Coordination Commissions with membership representing the public and private sectors and environmental groups, adjudicate local environmental matters, including appeals against charges and fines, the enforcement of legislation, etc. The commissions' decisions are binding pending appeals to the Ministry of Justice.

1.7 The overall thrust of Korea's environmental policies is highlighted in the Seventh Five-Year Plan (1991-96), which devotes an entire chapter to environmental issues. The Plan calls for the strengthening of environmental standards to the level of the advanced industrial countries and the strengthening of the "polluter pays" principle through raising the pollution excise tax and the introduction of advance deposits to ensure that the producers of toxic or nondegradable products (e.g. tires) finance their disposal.[3/] The Plan sets objectives and, in a number of instances, proposes quantitative targets[4/] in key environmental areas. These areas are: (a) water quality - raise the quality of drinking water, expand sewerage treatment, improve industrial waste water treatment and strengthen river water management; (b) waste management - expand the number of regulated landfills, improve recycling of household waste, establish waste salvage stations to collect and sort waste materials suitable for reutilization, and expand waste facilities; (c) air quality - expand the supply of clean fuels, tighten sulphur content in oils, raise auto emission standards and tighten enforcement of emission standards; (d) marine preservation - expand pollution dredging in port areas, improve waste water treatment in fishing areas, tighten pollution discharge controls and strengthen pollution control capabilities; and (e) environmental science and technology - preparation of a comprehensive plan for the development of environmental science and technology, promotion of R&D

3/ These deposits are paid into a waste products management fund (para 1.5).

4/ Plan targets include the establishment of 102 advanced sewerage treatment plants and 150 small and medium-scale plants, 38 million m^2 of landfill capacity and 51 incinerators of 200 tons/day capacity. In pursuit of improved air quality, LNG supply will be increased from 2.3 million tons/year (1990) to 6.6 million tons/year by 1996. Sulphur content for light oils will be reduced from 0.4% to 0.2% and for heavier oils from 1.6% to 1.0%.

projects in pollution measurement and control, and the development of low-pollution technologies.

B. Environmental Education

1.8 Concern for the environment is introduced early in the Korean education system. The most recent revision of primary and secondary schools' curricula (1987) placed special emphasis on environmental education. In the primary grades, environmental issues are addressed in the science and social studies courses and cover such topics as protection of the environment, pollution, and problems of land and population. An environmental education kit comprising student texts, teacher's guide, videos, etc. has been developed for the primary and junior secondary grades. At the secondary level, environmental education is also a part of the social studies and science curricula. It is built around a number of themes such as environmental preservation, industrialization, natural resources conservation, and these are included in individual subjects. For example, Korean Geography has a unit that deals with the impact of population growth on the environment; Science I has a biology unit which addresses pollution, resource utilization and protection of the environment.

1.9 The rising sensitivity to environmental issues, clearly reflected in the schools' curricula, is also reinforced by extra-curricular activities which include science fairs, nature protection clubs, science education broadcasts for sixth graders and the Environmental Monitoring Program under which volunteer senior secondary students monitor local environmental problems. Although much has been achieved in recent years, environmental education in the schools has been criticized as being inadequately focused because it is spread among different subjects rather than concentrated in specific environmental programs. Both approaches have merit and the present cycle of curricular revision is monitoring progress and will, in due course, make appropriate recommendations for the future treatment of environmental issues in the schools' curricula.

1.10 In higher education, the rising prominence of environmental concerns is reflected in the rapid increase in enrollments in environment-related programs. It is impossible to get a full picture of this trend because many students enrolled in natural science and engineering programs take specific environment-related courses within their degree programs but this is not reflected separately in enrollment data. However, where data exist, the growth trend over the last decade is clear. In the junior technical colleges (two-year post-secondary institutions), there were 25 departments of environmental management and technology enrolling 5350 students in 1991. In 1982, such departments did not exist. In the university faculties of engineering, there were 24 departments of environmental engineering with 5630 undergraduate students in 1991 compared with 6 departments enrolling 1150 students in 1982. In the agricultural colleges of the universities, 12 departments of environmental science and technology enrolled 2120 undergraduate students in 1991 whereas there were no such departments in 1982. In the graduate schools similar trends exist. In the engineering faculties, 35 programs enrolled 640 graduate students in 1991 as

compared with 4 programs and 35 students in 1982. In the agricultural colleges, there were 20 programs with enrollments of 590 in environmental science and technology in 1991 compared with zero in 1982.

C. Environmental Research

1.11 Overall environmental research priorities are defined within the context of the national Five Year Plan (para 1.7). They are also defined within MOST's long term science and technology (S&T) plan to year 2000 in which environmental topics form a subset within overall S&T strategies. The core of the S&T plan is the Highly Advanced New Technology Project which focuses on 11 areas of high technology-intensive research and development, with special emphasis on export potential. One priority area is environmental technology development with a strong focus on pollution control technology. These overall plans provide the macro-framework of policies and priorities from which ministries and individual institutions define their own research activities. Several ministries play a key intermediate role in reviewing institutional research programs - the Ministry of Education (MOE) for the universities, MOST for the majority of the national research institutes[5/] and MOEN for NIER. A recent decision has been made to transfer responsibility for the environmental technology part of the Highly Advanced New Technology Project from MOST to MOEN. Within individual institutions, internal procedures for reviewing research priorities and programs may differ but usually involve a high-level research review committee, reporting to the institution's head, who has the final responsibility for approval. The flow of information through the hierarchy of institutions from national plans to individual institutes is quite effective in Korea and has resulted in the broad range of S&T research efforts being generally relevant to the country's overall development objectives. This has undoubtedly made a substantial contribution to Korea's rapid industrialization.

1.12 Environmental research in Korea is carried out in a broad range of institutions - in university departments of natural science and engineering, in the agricultural and veterinary colleges, in a number of national research institutes and in the major private sector research institutes, and in the Ministry of Environment. While there are no formal demarcation lines between the research activities of the different institutional groups, particular fields of specialization can be discerned. Much basic research in environmental science is done in the university departments of natural science and aims at a better understanding of basic scientific relationships bearing on environmental problems. The departments of engineering have a greater focus on applied science and the development of technology in crucial areas such as pollution control and industrial waste management. The agricultural and veterinary colleges concentrate on a range of research topics relevant to rural environmental problems - this is discussed in more detail in para. 1.15.

5/ For a description of the role of MOE and MOST in reviewing institutional research programs, see: Staff Appraisal Report, Korea Universities Science and Technology Research Project, IBRD Report No. 8205-KO, April 23, 1990, pp. 3-6.

A number of national research institutes, mainly under the jurisdiction of the Ministry of Science and Technology, are expanding their environmental role. Increasing emphasis is being given to the development of pollution control technology, low pollution/ecologically sustainable production processes and improved environmental measurement techniques. Outreach programs to assist small and medium enterprises to address environmental problems are also being expanded by the institutes. The environmental activities of the major private sector research institutes reflect particular industry problems, e.g. reducing automobile exhaust emissions, waste water treatment, etc.

1.13 The Ministry of Environment has an important, though largely indirect, influence on overall environmental research through its policy formulation role. As new regulations in areas such as air, water and soil pollution, hazardous waste disposal, etc. are introduced and as higher standards of compliance are mandated, new demand is generated in the environmental research community for research into such topics as pollutant transfer phenomena, more accurate measurement of pollutant levels, improved environment-friendly technology, and so on. Complementing MOEN's policy formulation and regulatory roles is the National Institute of Environmental Research. NIER's research priorities are set by MOEN's Executive Committee, chaired by the Vice-Minister, in consultation with other relevant ministries, especially MOST. The latter also finances some of NIER's research programs. NIER has a staff of 184 including 99 researchers supported by 45 technical staff. About 90% of the research staff have graduate degrees. About 60 contract research staff, drawn mainly from the universities, are also employed by NIER. Research staff are employed mainly in the four research departments - air quality, water quality, waste management and environmental health. There are also two specialized laboratories conducting research into automotive emissions and lake water quality. NIER also acts as a national clearing house on environmental information and promotes international cooperation activities.

1.14 The dissemination of environmental research results is enhanced by the strong channels of communication within the environmental research community in Korea. This community is served by some 20 professional associations ranging from the specific, e.g. the Korea Society of Waste Management to the more general, such as the Korea Society of Biotechnology and Bioengineering. These associations are linked at the national level through the Korea Research Council on Environmental Sciences. The Council was established in 1987 to serve as an information exchange between the professional associations but has gained in influence and now serves as a source of advice to the Government on environmental policies. The Council has a formal annual meeting but sponsors more frequent meetings of its topical committees (environmental health, air quality, etc.). There is also a strong tradition in the scientific community to publish research results in international, national and local journals, and environmental scientists and technologists are significant participants. Symposia on environmental topics are held regularly and published proceedings are increasingly available. Dissemination also takes place through individuals participating in cooperative research programs such as the university researchers contracted to work in NIER and in the cooperative research projects involving the

universities and the national research institutes. The latter sometimes include researchers from the private sector.

D. Role of the Agricultural and Veterinary Colleges

1.15 Although many of the more visible environmental problems are in the cities and industrial areas, the rural areas where agriculture is the major activity, also suffer significant environmental degradation. The major problems relate to the pollution of soil and water from household and livestock wastes and agrochemicals, and also relate to the conservation of soil, forests and fisheries. A great deal more needs to be learned about the impact of polluting and depleting agents on the rural environment. The Government is looking to the colleges of agriculture and veterinary science in the universities to expand their research efforts. The colleges are already active in a number of major environment-related research fields. These include the study of animal waste as a pollutant of water and soil; the role of a range of agrochemicals as pollutants and research into crop-types which are less dependent on the use of agrochemicals; conservation of forests including the health and protection of species and the impact of air pollution and acid rain; soil, watershed and wildlife conservation; a range of issues related to environmental health including the impact of rural sewerage disposal, the chemical content of animal feed, food contaminants, pollution effects of fish farming, etc. Within these major fields, hundreds of individual research topics have been identified, whose implementation will be assisted under the proposed project.

1.16 The agricultural and veterinary colleges are also expected to provide better trained professionals in environmental fields. The latter are needed in increasing numbers in the agencies concerned with measuring and controlling pollution, managing waste disposal and improving the conservation of natural resources. The decentralization of environmental monitoring and enforcement functions to local authorities is already raising the demand for trained professionals (para. 1.6). The colleges are responding by moving their focus increasingly away from the traditional concentration on food production and animal health, towards issues affecting the rural environment.

1.17 The proposed project would focus on a part of Korea's system of agricultural and veterinary colleges. This system comprises 29 agricultural colleges (12 national and 17 private) and 10 veterinary colleges (9 national and 1 private). Total undergraduate enrollments in 1991 were about 54,600 comprising 45,770 in agriculture (including 6,100 in forestry) and 8,830 in veterinary and related programs. Total enrollments in the system have been increasing only marginally in recent years which reflects the changing role of agriculture in Korea. However, consistent with the broadening of the system's traditional interests (food production and animal health) towards inclusion of environmental concerns, enrollment growth in environment-related programs has been substantial (para. 1.10).

1.18 Women are under-represented in undergraduate agriculture and veterinary programs. In 1991, women accounted for only 26% of total enrollments in these programs and this proportion reflects the traditional

reluctance of women to enroll in science-related programs.[6/] No discriminatory practices exist which would discourage women from enrolling in science programs and the present enrollment pattern is largely the result of individual preferences. However, present trends favor a continued increase in female enrollments in agriculture and veterinary science. Whereas male enrollments increased at less than 4% p.a. during 1982-91, female enrollment rose by over 16% p.a. in the same period. Women now account for 56% of enrollment in horticulture, 39% in landscape architecture, 36% in agricultural biology and 34% in food science. In the graduate schools of agriculture and veterinary science, female enrollment is even less favorable, with women accounting for only 14% of total enrollments. However, female enrollments are increasing rapidly (18% p.a.) and this means that increasing numbers of women are qualifying to enter research positions.

E. Bank's Experience in Education and Research

1.19 The Bank has assisted Korea's technology development efforts through substantial support for the development of technical and scientific education and research.[7/] Bank lending has been consistent with Korea's needs and priorities in education and has closely paralleled the increasing sophistication of Korean industry. It was recognized that the restructuring of industry towards more skill-intensive, high-technology production would require the continuous expansion and upgrading of technical skills. Thus as industry developed towards greater skill-intensiveness, Bank assistance to education moved from support for craftsman and technician training through professional engineering education to graduate engineering programs and associated research activities.

1.20 The Bank's initial involvement in the sector under four loans/credits, focused on the development of vocational and technical education at the secondary and post-secondary levels to strengthen the base of the system for producing technical personnel. Project performance audit reports (PPARs) for these projects concluded that they were in general well-conceived and successfully implemented. The first education project in Korea (Cr. 151-KO) supported the expansion of vocational high schools, junior technical colleges and teacher training. It also financed technical assistance and fellowships to strengthen the planning and administration of vocational and technical education. The PPAR for the credit (Report No. 1801-KO, November 22, 1977) concluded that physical implementation was satisfactory but that some delays were experienced in recruiting and utilizing the experts under the technical

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6/ Women accounted for 29% of total university undergraduate enrollment in 1991. In natural sciences the proportion was 20% but if engineering is excluded, the proportion rises to 38%. In humanities, female enrollment was 48%.

7/ The Bank has also provided major support to technology development through directly financing R&D programs, strengthening intermediaries which finance R&D and providing credit for industrial development in general.

assistance component. The latter could have been overcome by more careful scheduling and a clearer definition of the experts' functions.

1.21 The second education project (Ln. 906/Cr. 394-KO) financed equipment for vocational high schools, junior technical colleges and undergraduate programs in science, engineering and education. The PPAR for the project (Report No. 4509, May 24, 1983) concluded that the project was implemented substantially as planned but with some delays due to over-optimistic scheduling. The third education project (Ln. 1096-KO) continued to support expansion and quality improvement in vocational high schools and junior colleges and for vocational training institutes (VTIs) under the Ministry of Labor. The project was implemented successfully and demonstrated the growing experience and competence of local project staff. The fourth education project (Ln. 1474-KO) supported a further expansion of VTIs and expansion and improvement of instructor training. The project completion report (PCR) for the project (Report No. 5516, March 8, 1985) concluded that the project was well designed, implemented efficiently and judged the project to be an excellent example of Bank/Borrower cooperation. It is reasonable to conclude that the first four projects demonstrated that the increased competence of local authorities led to improved project design and implementation. Project experience also demonstrated that there was a need to take a broader view of sectoral policies and issues after the implementation of four conventional projects. This was taken up in the two subsequent operations which were policy-oriented sector loans.

1.22 The first education sector loan (Ln. 1800-KO) concentrated on upgrading junior technical colleges and university colleges of engineering and management through the supply of equipment, staff development and institutional improvements in curriculum development, manpower planning, equipment maintenance and academic accreditation. The PPAR for the loan (Report No. 7252, May 24, 1988) concludes that the institutional improvements were achieved satisfactorily and indicates that the major lessons learned were: (a) a stable and responsible sector management agency was the key to successful implementation of the sector program; (b) the sector approach led to a quicker and more sustainable development of institutional capabilities; and (c) the additional time required for preparation was repaid in terms of more efficient implementation.[8/]

1.23 The second education sector loan (Ln. 2427-KO), which incorporated these lessons, assisted in supporting improvements in graduate education in science and engineering, upgrading secondary school and college science programs, expanding graduate research programs, improving sector management and manpower monitoring and strengthening the financial base of private educational institutions. Implementation of the loan was satisfactory and it closed on schedule on June 30, 1989. The PCR for the loan concludes that its

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8/ The Bank's positive role in Korea's education sector under the first five lending operations is documented in the OED report titled Review of the Impact of World Bank Lending for Educational Development in Korea (Report No. 5950; December 4, 1985).

objectives were largely met. Policy and institutional improvements of particular relevance to science education were introduced in relation to accreditation of colleges of natural science and science education departments, upgrading and expanding staffing of these institutions and the planning of facilities and equipment; at the secondary level, a new experimentation-oriented science curriculum was introduced, a system to monitor student achievement in science developed, new examination and college admission procedures introduced and science teachers upgraded through in-service training.

1.24 Following these education projects the Bank turned its attention to supporting research activities in the national research institutes and in the universities under three Technology Advancement Projects (TAPs) and the Universities Science and Technology Research Project. The three TAPs (Ln. 3037-KO, Ln. 3202-KO and Ln. 3315-KO) are assisting in raising the quality of research in a broad range of institutes, mainly under the Ministry of Science and Technology, through the provision of specialized equipment. The Universities Science and Technology Research Project (Ln. 3203-KO) is supporting the broadening and deepening of basic research programs in priority fields in science and technology. It builds on the policy changes in university research introduced under Ln. 2427-KO.

1.25 In the Vocational Education Project (Ln. 3314-KO), the Bank reverted to assistance to vocational training in recognition of the continuing need for craftsman training to keep pace with the increasingly complex skill requirements of the labor market. The recently approved Vocational Schools Development Project (Ln. 3469-KO) continues efforts to upgrade vocational education and includes institutional elements aimed at strengthening the link between schools and employers, more effective planning and improved staffing arrangements in the schools. The Science Education and Libraries Computerization Project (Ln. 3468-KO) aims to strengthen secondary and undergraduate science education and to improve information flows through the establishment of an automated inter-library network. All projects currently under implementation are proceeding satisfactorily.

II. THE PROJECT

A. Origin of the Project

2.1 The Government included the project in its CY92 list of projects suitable for external financing and formally asked the Bank for assistance in November 1991. Most of the preparation work was completed by the Government in accordance with guidelines formulated by the Bank. The project was preappraised in July-August 1992 and appraised in November 1992.

B. Project Rationale and Objectives

2.2 Over the past decade, the Government has begun to address seriously the environmental problems that have emerged from three decades of rapid growth. Wide-ranging legislation has been enacted and agencies have been established to implement this legislation and to provide policy and planning

guidance on environmental issues. To reinforce these activities, environmental education has been introduced into primary and secondary schools' curricula and into teacher training programs. College-level science courses are focusing increasingly on environmental issues and university research programs are also moving in this direction. However, in addressing environmental problems, the focus has been mainly on such problems as they relate to urban areas. Thus, most attention has been given to alleviating air and noise pollution in the cities and towns and to inland water pollution as it affects urban water supply. Published statistics reflect these priorities.[9/]

2.3 Increasingly however, rural environmental problems are receiving attention in a densely-populated country with scarce cultivable land and abundant forests (21% and 66% of total land area respectively). Cultivable land is becoming increasingly polluted through household, industrial and animal waste, and agrochemicals; inland and coastal waters are being polluted in a similar manner. Korea's forests, although extensive, need to be better managed to ensure effective conservation of soils and watersheds, efficient harvesting and replanting, reduction of pest damage and improved tree health, etc. This requires better trained professionals to measure and control pollution, manage forests and fisheries and operate the regulatory system. There is also a priority need to improve and expand research into key environmental problems related to land, water and forests. The agricultural and veterinary colleges have an important role to play in addressing these problems through research and teaching.

2.4 The proposed project provides the opportunity for the Bank to support Korea's policies for environmental improvement by strengthening environmental research and teaching in selected agricultural and veterinary colleges. The project would help to push the colleges more firmly towards addressing environmental concerns and in accelerating the pace of such involvement. It would also help to bring balance to Korea's environmental efforts, which have a strong urban focus, by strengthening the country's capacity to address rural environmental problems.[10/] The project design contains value added in the form of creating an efficient mechanism for centralizing common research activities (NICEM), which would be of particular benefit to smaller institutions. Value added would also be achieved through the establishment of suitable arrangements: (a) for the review and development of environment-related teaching programs which would help to maintain a focus on the quality and relevance of existing and future programs;

9/ Statistics include the various components of air quality, acid rain measurement and noise levels in the major urban centers. Industrial and domestic waste production levels are also monitored.

10/ The project would complement an Environmental Technology Development Project, proposed for Bank financing, which would focus on strengthening the capacity of selected national research institutes to develop appropriate technology for addressing environmental problems. The R&D work of the institutes has a strong industrial/urban focus.

and (b) to ensure that research programs are relevant to overall environmental policies and priorities.

2.5 The objectives of the proposed project are to assist selected colleges of agriculture and veterinary science to: (a) upgrade their capacity to undertake research into key environmental problems; (b) establish facilities for effective common research activities; (c) reinforce the environmental aspects of basic science programs in the colleges, in order to strengthen professional training in environmental fields; and (d) establish appropriate arrangements for the review of environment-related research and teaching programs.

C. Project Design and Description

2.6 The project would finance equipment with an estimated baseline cost of US$58.4 million. Bank-financed equipment would be allocated to NICEM (baseline cost, US$10.7 million), agricultural colleges (US$34.7 million) and veterinary colleges (US$13 million).[11/] The equipment forms the core of the project but in order to ensure that it is utilized effectively, complementary inputs (US$21.7 million) must also be supplied. These would be financed by the Government and cover local transportation and installation of equipment, O&M and consumable materials. The project would also include overseas training (US$1 million), visiting experts (US$0.7 million) and library materials (US$0.1 million), which would be financed by the Bank and included in the NICEM component (para. 2.10). The Government would finance all contingencies. Overall research priorities have been identified and detailed lists of research topics for each project institution have been prepared and are included in the project file. Equipment lists and outline specifications have also been prepared. Careful analysis has been made to ensure that there are strong linkages between research priorities, research topics and equipment lists.

2.7 NICEM would promote a more rational and efficient use of expensive research equipment and provide common facilities for scientists to pursue research programs that are more effectively carried out in a central location, than in separate institutions. NICEM would be established on the Suwon campus of Seoul National University (SNU) in two existing buildings, which are satisfactory for the purpose.[12/] The establishment of NICEM, together with its operational regulations, have been approved by the SNU Council. A director has been appointed for NICEM and an Advisory Committee established representing faculty, researchers and relevant ministries. A long-term operational plan has also been prepared. Equipment to be financed under the

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11/ Many complex items of equipment would be procured including a DNA sequencer, gas chromatograph, ultra centrifuge, extruder, etc. Procedures for the selection of equipment have been reviewed and are satisfactory.

12/ For the future, a new building is planned for NICEM with an area of about 10,000m^2 estimated to cost around US$8 million.

project (US$10.7 million), would help to establish the capacity of NICEM to undertake environment-related research, mainly in the fields of soil and water pollution, waste management, and soil, forest and watershed conservation. The project would finance books, journals and reference materials (US$0.1 million) to establish library facilities at NICEM. NICEM would have five divisions including three research divisions in environmental science, natural resources management and bio-engineering, and two support divisions in basic science and training. The latter would be responsible for training researchers to use complex pieces of research equipment. When fully operational, NICEM would have a staff of 47 including 25 research professors and assistants supported by 15 technical/ administrative staff. NICEM would be used by both public and private agricultural and veterinary colleges and its facilities would be of particular benefit to smaller institutions. Fees would be charged for NICEM's services and in the initial stages, fees are expected to generate about US$120,000 per year, which will be used to finance consumables and O&M for the equipment. During negotiations, the Government gave assurances that NICEM would carry out its assigned functions during implementation of the project and thereafter.

2.8 Equipment would be financed under the project (US$34.7 million) to assist in improving the quality of environment-related research and teaching in the 12 national agricultural colleges. The colleges are staffed with highly qualified faculty, many of whom have overseas doctorates and considerable work experience in overseas universities. The colleges teach many environment-related programs including generic courses such as agricultural chemistry and soil science, which have an environmental component, as well as specific courses dealing with water pollution, soil conservation, environmental impact of pesticides, etc. The content of existing environmental curricula is generally sound with good coverage of up-to-date concepts and issues, although there could be more practical content in a number of programs, thus giving them greater relevance to Korea's particular environmental problems. The major weakness lies in the lack of laboratory equipment to support teaching programs and this reflects past priorities for faculty development rather than hardware. The provision of equipment under the project would complement and reinforce previous investments in staff development. Equipment aimed at improving teaching programs is estimated to cost US$21.7 million. The remaining equipment (US$13 million) would finance research equipment aimed at enhancing the opportunities for faculty to carry out environment-related research in the individual colleges.

2.9 The project would finance equipment estimated to cost US$13 million for the nine national veterinary colleges. These colleges are staffed with highly qualified faculty, many of whom have research and teaching experience in overseas universities. The veterinary colleges offer a range of teaching programs with environmental components such as toxicology and biochemistry as well as courses in the field of environmental health. The major areas of research focus on animal waste pollution in soil and water, efficient treatment of animal wastes, manure control, effects of fish farming on water pollution, wildlife conservation, etc. Equipment estimated to cost US$2.5 million would be procured for research programs in the central veterinary laboratory at SNU and would be available for use by all veterinary staff at

SNU and to faculty from other colleges. Of the remaining equipment valued at US$10.5 million, about US$5 million would be allocated to the purchase of research equipment in the nine colleges to strengthen opportunities for faculty to undertake environmental research. Equipment estimated to cost US$5.5 million would assist in strengthening teaching of environment-related topics thus leading to the production of better trained environmental professionals. Special emphasis would be placed on increasing the practical content of courses. Graduates at the veterinary colleges are increasingly finding employment in the public and private sectors in such fields as environmental health, pollution monitoring, animal products, quarantine, wildlife conservation, etc.

2.10 The project institutions would be supported by a program of overseas training and visiting experts (US$1.7 million). Because environmental research and teaching is at a relatively early stage in the colleges, there is much to be gained from sending faculty overseas to gain experience and to learn from visiting experts. About 70 training fellowships would be awarded (60 agricultural and 10 veterinary) for periods of 1-12 months for a total of 450 study months. Fellows would be drawn from priority fields of environmental research which would include environmental chemistry, soil pollution and conservation, animal waste management, etc. Visiting experts would total about 12 (10 agricultural and 2 veterinary) and visits would average about three months. The experts would be expected to conduct seminars, advise on research issues, review and advise on teaching programs, etc. A schedule for overseas training fellowships and visiting experts has been agreed. Terms of reference for the visiting experts have also been agreed (Annex 1). During negotiations, the Government agreed to implement the overseas training and visiting experts program according to an agreed schedule. The program would be implemented by NICEM. Procedures have been agreed for the selection of fellows for overseas training, including criteria of selection. The key role would be played by the Selection Committee which has been set up in NICEM. Its terms of reference and membership have been agreed. The Selection Committee would review recommendations put forward by the deans of the colleges and make recommendations to the Director, NICEM who would have final responsibility for approving overseas training. In consultation with the deans of colleges, NICEM would also identify visiting experts and organize their work in-country.

2.11 In recent years, Korea's agricultural and veterinary colleges have moved increasingly to address problems of the environment in their teaching and research programs. In view of the rapidly rising interest in the environment within the Government and in the country in general, the colleges would benefit from a mechanism which would assess the quality and relevance of teaching programs (including the balance between theory and practice) in a systematic way and to guide future developments. This would help to ensure that the colleges' programs would remain relevant to environmental issues and lead to the production of better-trained environmental professionals. Under the project, the Environmental Education Review Committee (EERC) representing the colleges and relevant ministries would be established to carry out these tasks. There is also need for a suitable mechanism to provide guidance on the overall directions for environmental research in the colleges, advise on

changes in national environmental policies and priorities and assess the adequacy of resources being allocated to environmental research within the colleges. To address these needs, the project would establish the Environmental Research Advisory Committee (ERAC) with membership representing the colleges and relevant ministries. Terms of reference for the two committees (Annexes 2 and 3) have been agreed. During negotiations, the Government gave assurances that the initial meetings of the committees would be held by September 30, 1993 and convene thereafter on dates to be determined by the chairpersons, but no less than once in each academic year. The committees would report their findings through the Ministry of Education.

III. PROJECT COSTS, FINANCING AND IMPLEMENTATION

A. Costs

3.1 The total cost of the project is estimated at US$97.3 million equivalent, net of duties and taxes. The estimated cost by project component is summarized in Table 3.1 and by category of expenditure in Table 3.2. Detailed costs by component and category are given in Annex 4 and project expenditure by year and recipient in Annex 5.

Table 3.1: SUMMARY OF PROJECT COSTS BY COMPONENT

	Won Billion			US$ Million			Foreign as % of
	Local	Foreign	Total	Local	Foreign	Total	Total
NICEM	3.0	9.7	12.7	3.9	12.4	16.3	76
Agricultural Colleges	8.9	28.2	37.1	11.3	36.4	47.7	76
Veterinary Colleges	3.4	10.6	14.0	4.5	13.4	17.9	75
Baseline cost	15.3	48.5	63.8	19.7	62.2	81.9	76
Contingencies							
Physical	0.8	2.4	3.2	1.0	3.1	4.1	76
Price increase	3.3	5.5	8.8	4.2	7.1	11.3	63
Subtotal	4.1	7.9	12.0	5.2	10.2	15.4	66
Total Project Cost /a	19.4	56.4	75.8	24.9	72.4	97.3	74

/a Does not include duties, taxes and fees estimated at US$5 million.

SUMMARY OF PROJECT COSTS BY CATEGORY OF EXPENDITURE

	Won Billion			US$ Million			Foreign as % of Total
	Local	Foreign	Total	Local	Foreign	Total	
Equipment	-	45.6	45.6	-	58.4	58.4	100
Equipment transportation and installation	2.3	0.4	2.7	3.1	0.4	3.5	10
Operations and maintenance	6.4	0.7	7.1	8.2	0.9	9.1	10
Consumable materials	6.4	0.7	7.1	8.2	0.9	9.1	10
Overseas training	0.1	0.6	0.7	0.1	0.9	1.0	90
Visiting experts	0.1	0.4	0.5	0.1	0.6	0.7	80
Library materials	-	0.1	0.1	-	0.1	0.1	100
Baseline cost	15.3	48.5	63.8	19.7	62.2	81.9	76
Contingencies							
Physical	0.8	2.4	3.2	1.0	3.1	4.1	76
Price increase	3.3	5.5	8.8	4.2	7.1	11.3	63
Subtotal	4.1	7.9	12.0	5.2	10.2	15.4	66
Total project cost	19.4	56.4	75.8	24.9	72.4	97.3	74

3.2 Base costs are estimated at April 1993 prices. Equipment costs are estimated on the basis of master lists already drawn up and recent catalogue prices. Transportation and installation costs, the initial supply of consumables and the costs of operations and maintenance are based on recent experience in project institutions. Cost estimates for oversees training, visiting experts and library materials are similarly based on local experience. Duties and taxes, allowing for exemptions, are estimated at US$5 million.

3.3 The contingency allowance of US$15.4 million (about 19% of baseline costs) includes contingencies for unforeseen physical conditions and for estimated price increases. Physical contingencies were estimated at 5% of

baseline costs for training, visiting experts, library materials, equipment, transportation and installation of equipment, consumable materials and O&M expenditures. Price increase contingencies were calculated for both local and foreign costs in accordance with the following expected annual average price increase percentages: foreign cost, 3.1% in FY94 and thereafter and local cost, 5.5% in FY94 and 5% thereafter. Accordingly, aggregated price increases are estimated at about 13% of baseline costs plus physical contingencies.

3.4 The foreign exchange component of US$72.4 million (about 74% of total estimated project costs) has been calculated on the basis of the following foreign exchange percentages: equipment - 100%, overseas training - 90%, visiting experts - 80%, library materials - 100%, transportation and installation - 10%, consumables - 10% and O&M - 10%.

B. Financing

3.5 The proposed loan of US$60 million equivalent would finance about 83% of the estimated foreign exchange cost of the project or about 62% of total project costs net of duties and taxes. The Government would be responsible for the remaining 38% or US$37.3 million equivalent. The loan amount is limited to US$60 million by the foreign borrowing program and is therefore less than the foreign exchange cost of the project. The loan would finance 100% of the baseline cost of equipment and library materials, 90% for overseas training and 80% for visiting experts. All contingencies would be financed by the government. The loan amount would be allocated as follows: NICEM, US$12.3 million; agricultural colleges, US$34.7 million; and veterinary colleges, US$13 million. Loan funds would be made available to NICEM and to the participating colleges through MOE, as part of their annual budget allocations.

Table 3.3: FINANCING PLAN

Category of Expenditure	Government	IBRD	Total
	----------US$ million----------		
Equipment	-	58.4	58.4
Equipment transportation and installation	3.5	-	3.5
Operations and maintenance	9.1	-	9.1
Consumable materials	9.1	-	9.1
Oversees training	0.1	0.9	1.0
Visiting experts	0.1	0.6	0.7
Library materials	-	0.1	0.1
Contingencies	15.4	-	15.4
Total	37.3	60.0	97.3

Recurrent Expenditures

3.6 When fully operational, the project would generate recurrent costs for additional salaries (mainly support staff for NICEM) and for equipment-related consumable materials and O&M estimated at US$3.3 million p.a. This would be spread over 22 institutions thus averaging about US$150,000 per institution. These additional expenditures could be accommodated by the institutions without difficulty.

C. Project Management and Implementation

3.7 Overall responsibility for project implementation would lie with the Education Facilities Bureau (EFB) of MOE - an agency that has gained considerable experience in implementing Bank projects through its responsibility for earlier Bank operations. Physical aspects of the project would be handled within EFB by the Education Loan Projects Division (ELPD) including relations with the Office of Supply, Republic of Korea (OSROK) for equipment procurement. Assistance on educational issues would be provided by the University Education Office (UEO) of MOE and on research issues by the Science and Technology Education Bureau (STEB) and UEO. The University Education Administration Division of UEO would provide the administrative linkage with the institutions. An organization chart for MOE is given in Annex 6. The Academic Research and Promotion Division of UEO together with the Science Education Division of STEB would provide the research linkage with the institutions. The Project Coordinating Committee (PCC), which is operational under Ln. 3203-KO and Ln. 3468-KO, would also be responsible for general oversight of this project. The PCC would assist in coordination between participating bodies, provide policy advice on project-related matters and resolve major problems which might arise during project implementation. The project implementation schedule is shown in Annex 7. The Education Loan Projects Division would be responsible for routine correspondence and reporting to the Bank, and for financial and disbursement matters. ELPD has played this role in previous Bank projects and is staffed with experienced personnel.

3.8 The bulk of the work in equipment procurement would be undertaken by OSROK, which is highly experienced in procuring equipment under the Bank's international competitive bidding (ICB) procedures. On the basis of equipment lists and specifications provided by project institutions through ELPD, OSROK would prepare bidding documents, invite bids, evaluate them in conjunction with ELPD and the institutions and make contract awards with their agreement. The project institutions would be responsible for installation, initial testing and operation of the equipment, unless specified in the equipment contract that the supplier would perform these tasks. The institutions would also be responsible for maintenance and repair of the equipment including acquisition of spare parts, accessories and consumables, beyond the items and services initially supplied under the contract. The Bank would supervise the project twice yearly around March and September coinciding as far as possible with the preparation of the semi-annual progress reports (para. 3.14). Overall implementation issues would be handled by the task manager, assisted by a procurement specialist; technical aspects would be the responsibility of

a consultant in environmental science. A supervision plan is given in Annex 8.

Status of Project Preparation

3.9 The advanced stage of project preparation would allow implementation to commence immediately after loan signing. Project institutions have been identified and equipment lists and outline specifications prepared. Research topics have been identified. Project management authorities have been identified and competent staff are available to handle implementation activities. Implementation arrangements, including those for coordination between project agencies, have been agreed.

Procurement

3.10 Procurement arrangements are shown in Table 3.4. About 85% of the equipment would be procured on the basis of international competitive bidding (ICB) procedures in accordance with the Bank's guidelines. Equipment items in contracts valued at less than US$300,000 may be procured up to an aggregate limit of US$10.2 million through shopping procedures allowing for the comparison of quotations from at least three eligible suppliers. Local equipment manufacturers would be extended a 15% preference margin, or the prevailing customs duties, whichever is the lower, on bid evaluation under ICB. Local transportation, operations and maintenance costs on equipment, would be financed by the Government under local procedures. Installation costs and costs of consumables, if not included in the equipment contracts, would also be financed by the Government under local procedures. Fellowships for overseas training would be awarded on the basis of local Government procedures acceptable to the Bank. Visiting experts would be selected in accordance with Bank Guidelines for the Use of Consultants. Library materials would be procured on the basis of direct purchase after negotiating for discounts with publishers or their authorized distributors.

Table 3.4: SUMMARY OF PROPOSED PROCUREMENT ARRANGEMENTS

Category of expenditure	Procurement Method ICB	LCB	Other a/	NBF	Total cost including contingencies
	(US$ million)				
Equipment	57.5 (49.6)	-	10.2 (8.8)	-	67.7 (58.4)
Equipment transportation and installation	-	-	-	4.3 (0.0)	4.3 (0.0)
Operations and maintenance	-	-	-	11.5 (0.0)	11.5 (0.0)
Consumable materials	-	-	-	11.5 (0.0)	11.5 (0.0)
Overseas training	-	-	1.3 (0.9)	-	1.3 (0.9)
Visiting experts	-	-	0.9 (0.6)	-	0.9 (0.6)
Library materials	-	-	0.1 (0.1)	-	0.1 (0.1)
Total	57.5 (49.6)	- -	12.5 (10.4)	27.3 (0.0)	97.3 (60.0)

Note: Figures in parentheses are the respective amounts to be financed by the Bank loan.
NBF: Not Bank-financed.
a/ Includes international and local shopping, selection of fellows using existing Government procedures, selection of visiting experts following Bank guidelines for consultants, and direct purchase.

3.11 In accordance with successful practices for procurement under ICB used in recent education and technology advancement projects in Korea, OSROK would not be required to refer equipment contracts to the Bank for prior review before making contract awards. However, complete bidding documents including commercial terms, schedules of requirements and technical specifications would be sent to the Bank before each invitation to bid. Bid evaluation reports, documents and contracts would be retained by OSROK for ex-post review by Bank missions.

Disbursements

3.12 The proposed loan of US$60 million would be disbursed over a period of 5.5 years (Annex 9). This corresponds to the standard disbursement profile for education projects in Korea which is 5.5 years. The completion date of the project would be June 30, 1998 and the closing date December 31, 1998. Disbursements would be made on the basis of (a) 100% of foreign expenditures for imported equipment or, 100% of local expenditures (ex-factory cost) for locally manufactured equipment; (b) 65% of local expenditures for other equipment items procured locally; (c) 100% of foreign expenditures on overseas training and visiting experts; and (d) 100% of foreign expenditures on library materials. Reimbursement for technical assistance expenditures and for each equipment contract of US$300,000 equivalent or more, would be fully documented. Reimbursement for expenditures on library materials and for each equipment contract of less than US$300,000, would be made against statements of expenditure (SOE) for which full supporting documentation would be retained in MOE, for review as requested, by visiting Bank missions. Administrative and accounting capability in MOE is adequate to support the SOE procedure.

3.13 To facilitate disbursements, a special account, maintained in US dollars, would be set up at the Korea Exchange Bank in an amount of US$4 million, to cover the estimated average amount required to finance project expenditures for the next four months. Applications for replenishment of the special account would be submitted to the Bank on a monthly basis or whenever the amount requested exceeds one-third of the initial deposit, whichever comes first.

Accounts, Audits and Reporting

3.14 MOE would maintain project accounts in accordance with sound accounting practices. During negotiations, the Government gave assurances that audited accounts, including the special account and SOE, would be sent to the Bank within six months of the end of the financial year. Audit reports would include a separate opinion for expenditures under SOE procedures. The Government would submit semi-annual progress reports to the Bank in about March and September and provide status reports for visiting missions and, within six months of the closing date, submit Part II of the Project Completion Report.

D. Environmental Impact

3.15 The project would help to strengthen Korea's efforts to address environmental problems, especially as they relate to rural areas, by improving environment-related teaching and research in selected agricultural and veterinary colleges.

IV. BENEFITS AND RISKS

A. Benefits

4.1 The project would assist the agricultural and veterinary colleges in strengthening the teaching of environment-related courses which in turn would lead to better-prepared professionals becoming available to work in environmental fields in the public and private sectors. The project would also help to strengthen environmental research which would lead to a better understanding of key environmental problems thereby improving the basis for policy making and increasing the effectiveness of environmental protection programs.

B. Risks

4.2 There are no major risks associated with the project.

V. AGREEMENTS REACHED AND RECOMMENDATION

5.1 The Government has agreed to the following:

(a) NICEM would carry out its assigned functions during implementation of the project and thereafter (para. 2.7).

(b) the program of overseas training and visiting experts would be implemented according to an agreed schedule (para 2.10);

(c) initial meetings of the EERC and ERAC would be held by September 30, 1993 and the committees convened thereafter on dates to be determined by the chairpersons, but no less than once in each academic year (para 2.11);

(d) audit reports would be submitted by the Government to the Bank within six months of the end of each financial year (para. 3.14); and

(e) within six months of the closing date, Part II of the project completion report would be submitted to the Bank (para. 3.14).

5.2 Subject to the above conditions, the project constitutes a suitable basis for a Bank loan of US$60 million equivalent to the Republic of Korea for a term of 15 years, including 5 years of grace at the Bank's standard variable interest rate.

KOREA
ENVIRONMENTAL RESEARCH AND EDUCATION PROJECT

TERMS OF REFERENCE
VISITING EXPERTS IN ENVIRONMENTAL RESEARCH AND TEACHING

Each expert would be responsible for reviewing research and undergraduate and graduate teaching programs within his/her specified field of expertise and providing guidance as to how programs should be modified to better address Korea's environmental problems. In particular the expert would:

- Consult with EERC and ERAC to facilitate overall direction of the project;
- Review the curricula and teaching methods in environment-related programs at undergraduate and graduate levels and assess their quality and relevance in terms of international practice;
- Review the teaching resources (equipment, computers, library, field stations etc) and assess their adequacy in terms of international standards;
- Review the procedures for setting research priorities appropriate to Korea's present and anticipated environmental problems and recommend changes where necessary;
- Review how research proposals are evaluated and if necessary recommend alternative procedures based on current international practice;
- Provide advice on improving existing and proposed research programs, including alternative/emerging methodologies, equipment or data analysis procedures;
- Present seminars on the current state-of-the-art in environmental research as well as on the application of standard procedures to deal with common or widespread environmental problems;
- Give workshops/demonstrations of particular instruments or procedures, including field demonstrations where appropriate;
- Where possible within the time frame available, engage in collaborative research with local scientists;
- Facilitate international cooperation in environmental research, both with developed and developing countries.

KOREA
ENVIRONMENTAL RESEARCH AND EDUCATION PROJECT
Environmental Education Review Committee - Terms of Reference

Objective

The main purpose of the Environmental Education Review Committee (EERC) will be to ensure that environment-related teaching programs in the agricultural and veterinary colleges are relevant to the major environmental issues being faced in Korea and lead to the production of better-trained environmental professionals. The EERC would assess the quality and relevance of existing teaching programs (including the balance between theory and practice) and provide guidance on the development of future programs. Such guidance would reflect, inter alia, the experiences of the major employers of environmental professionals. The EERC would report to the colleges through the Ministry of Education. Specialized subcommittees would be formed as necessary to address specific issues in agricultural and veterinary fields.

Membership

The membership of EERC will comprise faculty members from the colleges of agriculture and veterinary science representing the major teaching areas, together with representatives of the major employers of environmental professionals plus the Ministry of Education. Membership would be as follows:

Chairperson	-	senior faculty member from an agricultural college
Vice-chairperson	-	senior faculty member from a veterinary college
Members*	-	faculty members, agricultural colleges
Members*	-	faculty members, veterinary colleges
Member	-	representative, Ministry of Environment
Member	-	representative, Ministry of Agriculture, Forests and Fisheries
Member	-	representative, Rural Development Administration
Member	-	representative, Ministry of Health and Social Affairs
Member	-	representative, Ministry of Education

* Membership to be determined by college deans in consultation with the chairperson and vice-chairperson.

Functions

The major functions of EERC would be to:

(a) Assess the quality and relevance of existing environmental teaching programs in relation to the needs of the major employers of environmental professionals.

(b) Advise on the content and relevance of proposed future environmental teaching programs.

(c) Provide guidance to the colleges on changes in manpower demand in environmental fields and the implications of such changes for teaching programs.

(d) Keep abreast of changes in national environmental policies and priorities and advise the colleges on the relevance of such changes for teaching programs.

KOREA
ENVIRONMENTAL RESEARCH AND EDUCATION PROJECT
Environmental Research Advisory Committee - Terms of Reference

Objective

The main purpose of the Environmental Research Advisory Committee (ERAC) will be to ensure that the environmental research programs of the agricultural and veterinary colleges are consistent with the overall environmental policies and priorities of Korea, with special emphasis on rural environmental issues. ERAC will not become involved in the internal procedures under which the colleges identify and prioritize research programs. Its responsibility will be to review the major directions in which the environmental research programs of the agricultural and veterinary colleges are moving and advise on their relevance to national environmental policies and priorities. ERAC will also provide guidance to the colleges on likely future changes of environmental policy so that the colleges may react accordingly. ERAC would report to the colleges through the Ministry of Education. Specialized subcommittees would be formed as necessary to address specific issues in agricultural and veterinary fields.

Membership

The membership of ERAC will comprise representatives of the agencies which have direct responsibilities for environmental matters or have a close indirect interest in them. Membership would be as follows:

Chairperson	-	senior faculty member from an agricultural college
Vice-chairperson	-	senior faculty member from a veterinary college
Member	-	faculty member, agricultural college
Member	-	faculty member, veterinary college
Member	-	representative, Ministry of Environment
Member	-	representative, Ministry of Education
Member	-	representative, Ministry of Agriculture, Forests and Fisheries
Member	-	representative, Ministry of Science and Technology
Member	-	representative, Rural Development Association

Functions

The main functions of ERAC would be:

(a) Review annually the major fields of environmental research being proposed by the agricultural and veterinary colleges in their budget submissions, in terms of national environmental policies and priorities. Provide appropriate advice as necessary;

(b) Keep abreast of environmental policies and priorities and advise the colleges of relevant changes;

(c) Assess the adequacy of resources (human and financial) being allocated to environmental research in the colleges and make recommendations for their increase as necessary;

(d) In view of the strong interdisciplinary nature of environmental research, promote cooperation between researchers in different disciplines; and

(e) Review the annual report of NICEM and make recommendations as appropriate.

KOREA

ENVIRONMENTAL RESEARCH AND EDUCATION PROJECT

Detailed Project Costs
(Won million)

	Equipment	Equipment Transportation and Installation	O & M	Consumable Materials	Technical Assistance and Library Materials	Total Cost Won M	Total Cost US$ M
NICEM	8,346	505	1,311	1,311	1,248	12,721	16.3
Agricultural Colleges	27,066	1,706	4,146	4,146	-	37,064	47.7
Veterinary Colleges	10,140	614	1,597	1,597	-	13,948	17.9
Baseline Cost	45,552	2,825	7,054	7,054	1,248	63,733	81.9
Contingencies							
Physical	2,278	141	367	367	84	3,237	4.1
Price Increase	5,007	398	1,546	1,546	317	8,814	11.3
Subtotal Contingencies	7,285	539	1,913	1,913	401	12,051	15.4
Total Project Cost							
Won million	52,837	3,364	8,967	8,967	1,649	75,784	
US$ million	67.7	4.3	11.5	11.5	2.3		97.3

Annex 4

KOREA

ENVIRONMENTAL RESEARCH AND EDUCATION PROJECT

Project Expenditure by Year and Recipient

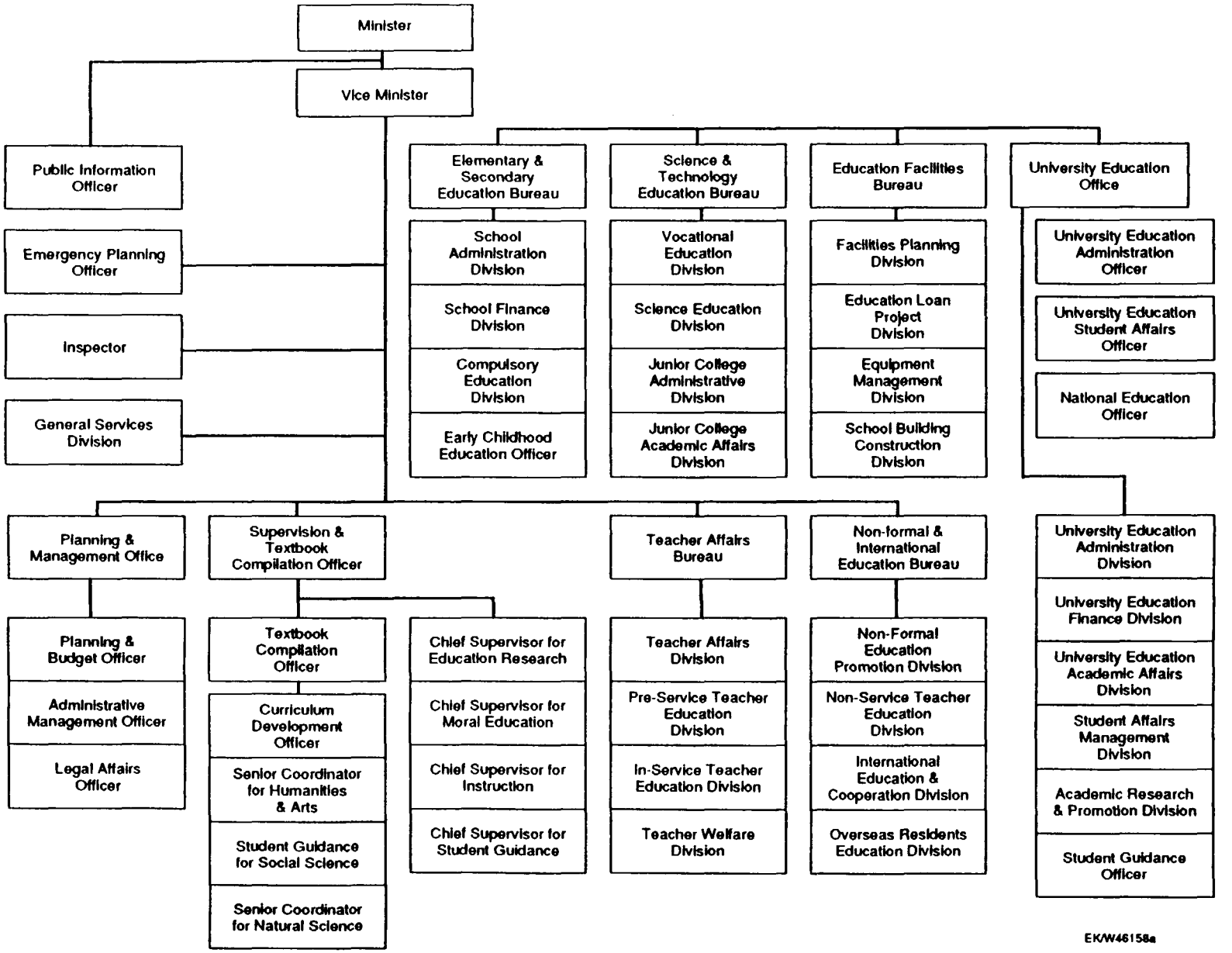
	Base Costs (Won million)						Total Cost	
	93/4	94/5	95/6	96/7	97/8	98/9	Won M	US$M
NICEM	929	2,362	4090	3,180	1,918	242	12,721	16.3
Agricultural Colleges	2,486	6,440	12,772	9,182	5,139	1,045	37,064	47.7
Veterinary Colleges	955	2,418	4,515	3,552	1,932	576	13,948	17.9
Baseline Cost	4,370	11,220	21,377	15,914	8,989	1,863	63,733	81.9
Contingencies								
Physical	218	566	1,092	820	449	92	3,237	4.1
Price Increase	93	731	2,604	2,731	1,984	671	8,814	11.3
Total Project Cost	4,681	12,517	25,073	19,465	11,422	2,626	75,784	97.3
Foreign Exchange	4,049	10,468	20,561	14,396	6,291	377	56,142	72.4

Annex 5

KOREA

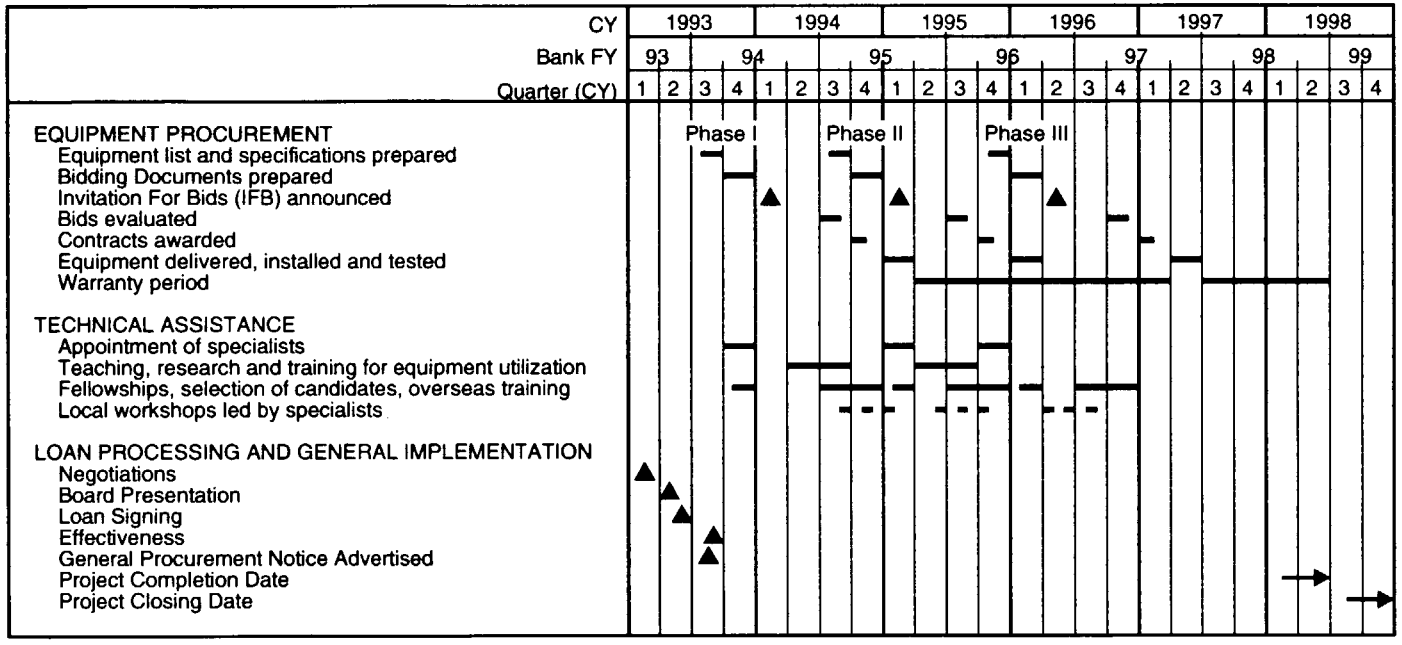
ENVIRONMENTAL RESEARCH AND EDUCATION PROJECT

Organization of the Ministry of Education



Annex 6

KOREA
ENVIRONMENTAL RESEARCH AND EDUCATION PROJECT
Implementation Schedule



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Annex 7

KOREA
ENVIRONMENTAL RESEARCH AND EDUCATION PROJECT

SUPERVISION PLAN

Approximate Dates (Month/Year)	Activity	Expected Skill Requirements	Staff Input (Staff-weeks)
9/93	Supervision Mission Review final equipment lists and specifications for Phase I procurement	Project management Environmental science	1.0 1.0
3/94	Supervision Mission Review semi-annual progress report Review sample of bid evaluation reports Review SOE documentation Review TA program	Project management Procurement	1.0 1.0
9/94	Supervision Mission Review final equipment lists and specifications for Phase II procurement Review progress report Review sample of bid evaluation reports and SOE documentation Review TA program	Project management Environmental science Procurement	2.0 2.0 1.0
3/95	Supervision Mission Review progress report Visit selected laboratories to review equipment utilization. Review sample of bid evaluation reports and SOE documentation Review TA program	Project management Environmental science Procurement	1.0 1.0 1.0

KOREA
ENVIRONMENTAL RESEARCH AND EDUCATION PROJECT

SUPERVISION PLAN

Approximate Dates (Month/Year)	Activity	Expected Skill Requirements	Staff Input (Staff-weeks)
9/95	Supervision Mission Review progress report Review final equipment lists and specifications for Phase III procurement Review sample of bid evaluation reports and SOE documentation Review TA program	Project management Procurement	2.0 1.0
3/96	Supervision Mission Review progress report Review sample of bid evaluation reports and SOE documentation Visit selected laboratories to review equipment utilization Review TA program	Project management Environmental science Procurement	2.0 1.0 1.0
9/96	Supervision Mission Review progress report Review sample of bid evaluation reports and SOE documentation Review TA program	Project management Procurement	2.0 1.0
3/97	Supervision Mission Review progress report Review sample of bid evaluation reports and SOE documentation Visit selected laboratories to review equipment utilization Review TA program	Project management Environmental science Procurement	2.0 1.0 1.0

KOREA
ENVIRONMENTAL RESEARCH AND EDUCATION PROJECT

SUPERVISION PLAN

Approximate Dates (Month/Year)	Activity	Expected Skill Requirements	Staff Input (Staff-weeks)
9/97	Supervision Mission Review progress report Review sample of bid evaluation reports and SOE documentation Review TA program	Project management Procurement	2.0 1.0
3/98	Supervision Mission Review progress report Review sample of bid evaluation reports and SOE documentation Visit selected laboratories to review equipment utilization	Project management Environmental science Procurement	2.0 1.0 1.0
9/98	Supervision Mission Prepare for PCR	Project management	2.0
3/99	Completion Mission Prepare PCR	Project management Environmental science Procurement	2.0 2.0 1.0

ANNEX 9

KOREA

ENVIRONMENTAL RESEARCH AND EDUCATION PROJECT

Disbursements

IBRD Fiscal Year and Semester	Disbursements			Disbursements Profile /a (%)
	Semester	Cumulative	as % of Total	
	----------US$----------			
1994				
1	4.0 /b	4.0	7	1
2	0.0	4.0	7	3
1995				
1	4.0	8.0	13	5
2	8.0	16.0	27	10
1996				
1	11.0	27.0	45	23
2	11.0	38.0	63	44
1997				
1	9.0	47.0	78	70
2	6.0	53.0	88	81
1998				
1	3.0	56.0	93	92
2	3.0	59.0	98	97
1999				
1	1.0	60.0	100	100

/a Standard disbursement profile for education projects in Korea.

/b Initial deposit in Special Account.

ANNEX 10

KOREA

ENVIRONMENTAL RESEARCH AND EDUCATION PROJECT

Selected Documents Available in the Project File

A. Reports and Studies Related to the Sector/Subsector

* A-1 Problems and Issues in Science Education in Korea, Han Jong-Ha, KEDI, September 1986.

* A-2 Education in Korea 1989-90, MOE.

* A-3 Korea Higher Education - Its Development, Aspects and Prospects, KCUE, 1990.

A-4 Environmental Protection in Korea, Ministry of Environment, Republic of Korea, 1990.

A-5 National Report of the Republic of Korea to UNCED 1992, Ministry of Environment, Republic of Korea, December 1991.

A-6 Environmental Education in Asian Countries, AST/IBRD, April 1991.

B. Reports and Studies Related to the Project

** B-1 IBRD Natural Resources Management Education and Research Project, IBRD Education Loan Committee/KANCA, 1992.

B-2 Agriculture and Veterinary Medical Education Development Project, MOE, June 1992.

B-3 Environmental Research and Education Project - Korea, Report on Technical Aspects, Ian Irvine, September 1992.

** B-4 IBRD Natural Resources Management Education and Research Project (Veterinary Medicine), IBRD Education Loan Committee, KANCVM, 1992.

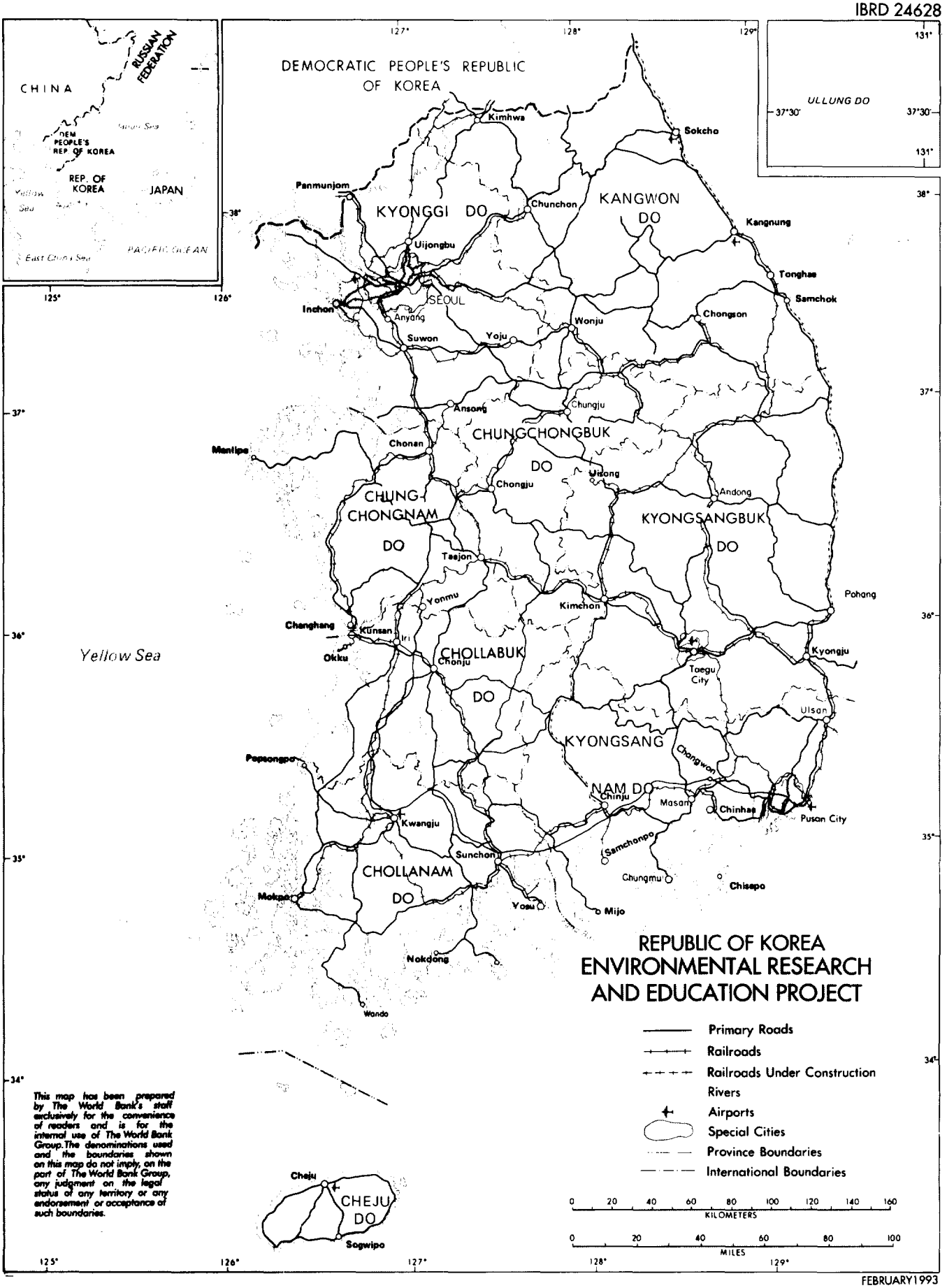
B-5 Training and Technical Assistance Program for 1992 IBRD Environmental Management Education and Research Project, 1993.

B-6 Report on NICEM, March 1993.

* - See Project File for the Science Education and Libraries Computerization Project (Ln. 3468-KO).

** - Includes equipment lists.

IBRD 24628



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FEBRUARY 1993